MONITORING PLAN

PROJECT NO. PO-16 BAYOU SAUVAGE (Phase I)

ORIGINAL DATE: June 19, 1995
REVISED DATE: July 23, 1998

Preface

Pursuant to a CWPPRA Task Force decision on April 14, 1998, the original monitoring plan was reduced in scope due to budgetary constraints. Specifically, frequency of vegetation monitoring was reduced from annual to every three years.

Project Description

The hydrologic restoration project area is located in the Bayou Sauvage National Wildlife Refuge just 16 mi (25.8 km) east of New Orleans in Orleans Parish (figure 1). The 3,800 ac (1,538 ha) site is south of U.S. Highway 90, west of the Ponchartrain Hurricane Levee, north of the Gulf Intracoastal Water Way, and east of the Maxtent Canal levee. The Bayou Sauvage Refuge was established in 1986 to enhance overwintering waterfowl, shore bird, and wading bird populations in an urban setting. The *Salix nigra* (black willow) habitat within this project area is an important wading bird rookery area. The main objective of this project is to reduce water levels in order to enhance fresh marsh and willow regrowth.

The Lake Ponchartrain Hurricane Protection Levee built in 1956 isolated parts of the refuge from the surrounding marsh complex, creating large freshwater impoundments with water depths ranging from 1 to 2 ft (0.3 to 0.6 m). The majority of the wetland soils in the project area are Clovelly and Lafitte mucks characterized by fluid organic soils underlain by clay. Fresh marsh and submersed aquatics occur on the wet soils. The dredged material deposits forming the Hurricane Protection Levee are Aquent soils, which are highly variable and slightly saline. The Bayou Sauvage natural levee along the northern part of the area is Sharkey soil, which is a firm mineral soil. Bottomland hardwoods and willow are found on the higher elevations on the Aquent and Sharkey soils (USFWS 1994).

Although approximately 117 ac/yr (47.3 ha/yr) were lost from 1956 to 1978 throughout the refuge, land loss within the impoundments was 81 ac/yr (32.8 ha/yr) compared to 36 ac/yr (14.6 ha/yr) in the tidal areas (USFWS 1994). This was a result of flooding of emergent fresh marsh and willow vegetation leading to large open-water ponds. Subsequent breaks in the containment levees exposed pond surfaces to drying and compaction. However, there was no organized management of the area in recent history. The elevation of open-water ponds is currently below zero ft NGVD (USFWS 1994). When the levees were rebuilt and drainage ceased, these lower areas were covered with shallow impounded water from 1 to 2 ft deep that prevented regrowth of emergent vegetation. This project proposes to lower water levels to enhance revegetation. Two 48 in (1.2 m) pumps will be installed on the east side of the area to draw water levels down approximately 1.0 to 1.5 ft in the spring and summer. The pumps will be used to maintain water levels within 0.5 ft of root mat levels

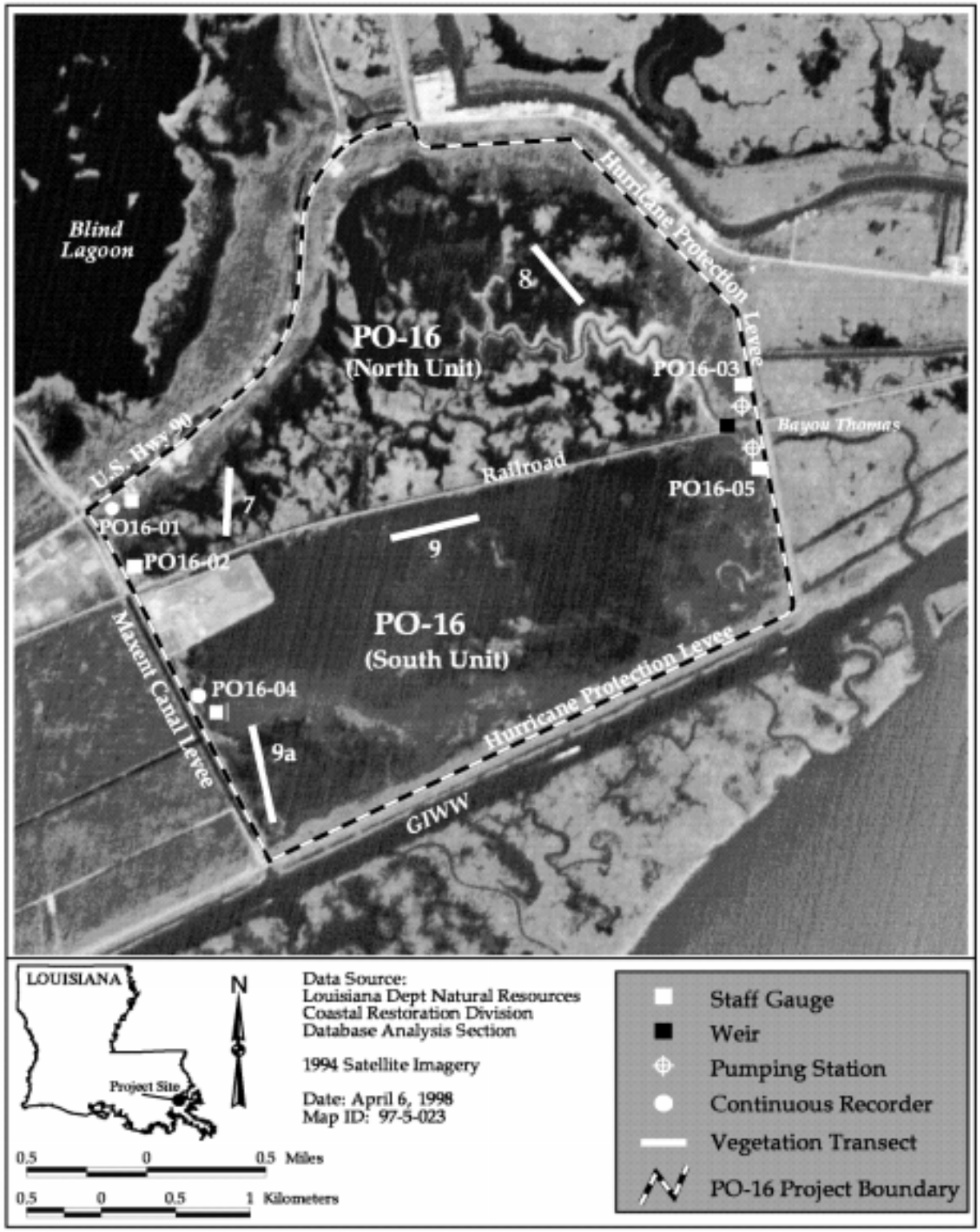

Figure 1 . Project boundary and features for Bayou Sauvage Hydrologic Restoration (PO-16) project.

during the fall and winter. The current marsh level was determined by extensive elevational surveys (USFWS 1994). A plug will be installed on Bayou Thomas to ensure that the areas north and south of the railroad are separated. The area north of the railroad will have water levels drawn down an average of 1 ft in the spring and summer. The southern area has experienced greater subsidence and water will be drawn down approximately 1.5 ft in the spring and summer. The two areas will be managed independently.

Project Objective

1. To enhance fresh marsh habitats in the project area.

Specific Goals

The following measurable goals were established to evaluate project effectiveness:

1. Promote the reestablishment of emergent marsh vegetation.

2. Lower water levels within the impounded areas to -0.5 ft to 0.0 ft of marsh sediment elevation in the spring and summer and to within +0.5 ft of marsh sediment elevation throughout the rest of the year via the installation of pumps.

3. Maintain black willow habitat in order to promote wading bird rookeries.

Reference Area

The reference area will be monitored and evaluated in a similar fashion to provide a means to achieve statistically valid comparisons. This will provide a measurement of the project's success. Sites near the project area were considered based on the criteria that they be impounded and with a similar water depth and hydroperiod to the project area, and have similar vegetative communities and soil types. An area north and west of I-10 and east of a levee along Paris Road was chosen since it was impounded, had open-water areas with and without submersed aquatics with water levels within 1 to 2 ft, had fresh/intermediate marsh, bottomland hardwood and willow habitat, and had Clovelly and Lafitte muck soils similar to the project area.

However, some differences between the reference area and the project area do exist. The reference area is subject to tidal influence during the spring via gates connecting the area with Lake Pontchartrain. Also, the willow habitat within the reference area is not inundated year round and the willows present are alive and in good condition similar to the higher areas within the project area. Four vegetation transects established within the reference area correspond to the four transects within the project area and were chosen to be representative of the major habitat types present. The first transect has healthy willows, the second transect is mainly *Spartina patens* (marshhay cordgrass), the third transect is an open-water pond with submersed aquatics, and the fourth transect is an open-water pond with no submersed aquatics (figure 1). Three staff gauges are located within the

reference area and will be monitored by the United States Fish and Wildlife Service on the same day as those within the project area. The reference area was flown for habitat mapping during the preconstruction project flight (November 1993 at 1:12,000) and will be flown simultaneously with the three post-construction flights. All monitoring elements will be evaluated identically for the project and reference areas.

Monitoring Elements

The following monitoring elements will provide the information necessary to evaluate the specific goals listed above:

1. Habitat Mapping — To document marsh to open water ratios in the project and reference areas, color infrared aerial photography (1:12,000 scale with ground controls) will be obtained. The photography will be georectified, photointerpreted, mapped, and analyzed with GIS by the National Wetland Research Center (NWRC) using standard operating procedures documented in Steyer et al. (1995). The photography will be obtained prior to construction (1993), and post-construction in 1996, 2006 and 2012.

2. Water Level — Will be measured using staff gauges at 5 locations within the project area (three in the northern area, and two in the southern area) and at three locations within the reference area. The location and number of staff gauges were determined by USFWS personnel using information gathered during field investigations of water flow throughout the areas. The staff gauges will be monitored weekly by USFWS personnel. The staff gauges' elevations will be surveyed relative to National Geodetic Survey Station H 374 (National Geodetic Survey 1993) at the intersection of Recovery Road and Highway 90. The staff gauges'elevations will be surveyed upon project completion, and in 2000, 2006, and 2012. The target water level is in relation to marsh surface elevation which was determined by USFWS and SCS using techniques described in Steyer 1995.

3. Vegetation — Species composition, percent cover and relative abundance of plant species will be evaluated using techniques described in Steyer and Stewart (1992). Four transects in the project and reference area will be monitored using the line-intercept method described in Harris (1989). This area was formerly fresh/intermediate marsh, bottomland hardwood and open-water pond. The two transects in the northern area were chosen to be representative of fresh marsh habitat and *Spartina patens* habitat. The two transects designated in the southern area were chosen to be representative of the submersed aquatic habitat in the open-water pond and the black willow habitat.

Vegetation will be monitored in 1996, 1997, 2000, 2003, 2006, 2009, 2012, and 2015.

Anticipated Statistical Tests and Hypotheses

The following hypotheses correspond with the monitoring elements and will be used to evaluate the accomplishment of the project goals.

1. Descriptive and summary statistics on historical data and data collected during postproject implementation. Data from aerial photography and GIS interpretation will be used to determine trends in marsh- to open-water ratios.

   Goal: Promote the reestablishment of emergent marsh vegetation.

   A. *Hypothesis:*

      H_0: Marsh:open-water ratio after project implementation at time i will not be significantly higher than the marsh:open-water ratio before project implementation.

      H_a: Marsh:open-water ratio after project implementation at time i will be significantly higher than the marsh:open-water ratio before project implementation.

      If we fail to reject the null hypothesis, we will investigate for negative effects.

   B. *Hypothesis:*

      H_0: Marsh:open-water ratio after project implementation at time i will not be significantly higher than the marsh:open-water ratio in the reference area.

      H_a: Marsh:open-water ratio after project implementation at time i will be significantly higher than the marsh:open-water ratio in the reference area.

      If we fail to reject the null hypothesis, we will investigate for negative effects.

2. The primary method will be to determine differences in water level as evaluated by an ANOVA that will consider spatial and temporal variation and interaction. The ANOVA approach may include terms in the model to adjust for station locations, proximity to structures, and seasonal fluctuations. Ancillary data (*i.e.*, precipitation, historical) will be used when available. This additional information may be evaluated through analyses such as correlation, trend, multiple comparisons, and interval estimation. These tests will allow for the analysis and long-term documentation of water level changes in the project area (goal 1). Data will be obtained from staff gauges within the project area.

Goal: Lower water levels within the impounded areas to -0.5 ft to 0.0 ft of marsh sediment elevation in the spring and summer and to within +0.5 ft of marsh sediment elevation throughout the rest of the year via the installation of pumps.

A. *Hypothesis:*

H_0: After construction, mean water level within the project area at time i will not be significantly lower than water level before construction.

H_a: After construction, mean water level within the project area at time i will be significantly lower than water level before construction.

If we fail to reject the null hypothesis, we will investigate for negative effects.

B. *Hypothesis:*

H_0: After construction, mean water level within the project area at time i will not be significantly lower than water level in the reference area.

H_a: After construction, mean water level within the project area at time i will be significantly lower than water level in the reference area.

If we fail to reject the null hypothesis, we will investigate for negative effects.

C. *Hypothesis:*

H_0: After construction, mean water level within the project area at time i during the spring and summer will be significantly greater than or equal to -0.5 ft of the mean sediment elevation or less than or equal to 0.0 ft of the marsh sediment elevation.

H_a: After construction, mean water level within the project area at time i during the spring and summer will be significantly greater than 0.0 ft marsh sediment elevation or less than -0.5 ft marsh sediment elevation.

If we fail to reject the null hypothesis, we will investigate for negative effects.

D. *Hypothesis:*

H_0: After construction, mean water level within the project area at time i during the fall and winter will be significantly less than or equal to +0.5 ft of marsh sediment elevation.

H_a: After construction, mean water level within the project area at time i during

the fall and winter will be significantly greater than 0.5 ft marsh sediment elevation.

If we fail to reject the null hypothesis, we will investigate for negative effects.

3. The primary approach will be to determine differences in vegetation as evaluated by an ANOVA that will consider spatial and temporal variation and interaction. The ANOVA approach may include terms in the model to adjust for station/transect locations, location in relationship to the railroad, proximity to structures, and seasonal fluctuations. Ancillary data (*i.e.*, salinity, herbivory, historical data provided in Harris 1989) will be used when available. This additional information will be evaluated through analyses such as correlation, trend, multiple comparisons, and interval estimation. These tests will allow for the analysis and long-term documentation of changes in the occurrence of emergent marsh vegetation.

Goal: Promote the reestablishment of emergent marsh vegetation.

A. *Hypothesis:*

H_0: Mean occurrence of emergent marsh at time i will not be significantly greater after project implementation than occurrence of emergent marsh before project implementation.

H_a: Mean occurrence of emergent marsh at time i will be significantly greater after project implementation than occurrence of emergent marsh before project implementation.

If we fail to reject the null hypothesis, we will investigate for negative effects.

B. More specifically, the wetland value assessment predicted the restoration of 1,050 ac (425 ha) of emergent wetland by yr 5 of the project.

Hypothesis:

H_0: Mean occurrence of emergent marsh at 5 yrs will not be 1,050 ac greater than occurrence of emergent marsh before project implementation.

H_a: Mean occurrence of emergent marsh at at 5 yrs will be 1,050 ac greater than occurrence of emergent marsh before project implementation.

If we fail to reject the null hypothesis, we will investigate for negative effects.

C. These tests will allow for the analysis and long-term documentation of changes in the occurrence of black willow vegetation. Current estimates of black willow coverage are 30% (USFWS 1994).

Goal: Maintain black willow habitat in order to promote wading bird rookeries.

Hypothesis:

H_0: Mean occurrence of black willow vegetation at time i will not be significantly greater after project implementation than occurrence of black willow vegetation before project implementation.

H_a: Mean occurrence of black willow vegetation at time i will be significantly greater after project implementation than occurrence of black willow vegetation before project implementation.

If we fail to reject the null hypothesis, we will investigate for negative effects.

NOTE: Available ecological data, both descriptive and quantitative, will be evaluated in concert with statistical analyses to determine overall project success.

Notes

1.	Implementation:	Start Construction:	August 1, 1995
		End Construction:	May 1, 1996
2.	USFWS Point of Contact:	Pondexter Dixson	(504) 646-7545.
3.	DNR Project Manager:	George Boddie	(504) 342-6878
	DNR Monitoring Manager:	John Troutman	(504) 342-1952
	DNR DAS Assistant:	Brian Zielinski	(504) 342-4123

4. The twenty year monitoring plan development and implementation budget for this project is $360,328. Progress reports will be available in November 1996, May 1997, and May 1998, and comprehensive reports will be available in May 2001, May 2004, May 2007, May 2010, May 2013, and May 2016. These reports will describe the status and effectiveness of the project.

5. DNR will conduct vegetative monitoring.

6. In November 1993, near-vertical, color-infrared aerial photography was flown of the project area at a scale of 1:18,000 by NBS.

7. USFWS will install and monitor staff gauges. Staff gauge readings taken for one year preconstruction (1994 - 1995) have shown that the spring and summer water level is approximately -0.2 ft and the fall and winter water level is from +1.0 to +1.5 ft. These relative readings will be converted to NGVD when the staff gauges are surveyed postconstruction and every five years thereafter.

8. USFWS will do bird counts and collect wildlife data for the project. This data will be ancillary information used by DNR for interpretation in reports.

9. References, miscellaneous reports and/or data available from this project area:

Coastal Environments, Inc. 1986. A Wetland Management Program for the Bayou Chevee Marsh. Prepared by Coastal Environments Inc. for South Point Inc., Chicago, Illinois.

Harris, J. 1989. Floristic Survey of the (Proposed) Bayou Sauvage National Wildlife Refuge. Slidell, La.: U.S. Fish and Wildlife Service, Refuge Division. 50 pp.

Steyer, G. D., and R. Stewart 1992. Monitoring Program for Coastal Wetlands Planning, Protection, and Restoration Projects. Open File Report 93-01. Lafayette, La.: U.S. Fish and Wildlife Service, National Wetlands Research Center. 85 pp.

Steyer, G. D., R. C. Raynie, D. L. Steller, D. Fuller, and E. Swenson 1995. Quality management plan for Coastal Wetlands Planning, Protection, and Restoration Act monitoring program. Open-file series no. 95-01. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division.

U.S. Fish and Wildlife Service 1994. Final Environmental Impact Statement: Bayou Sauvage National Wildlife Refuge. Slidell, La. U.S. Fish and Wildlife Service.

U. S. Soil Conservation Service 1992. Conservation Plan for Bayou Sauvage National Wildlife Refuge, Louisiana.